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# Soil Nutrient -Vegetation Relationship in the Forest Research Institute, Yezin.

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# ရေဆင်း- သစ်တောသုတေသနဌာနရှိ သစ်တောသစ်ပင်များနှင့် မြေဆီဩဇာဆက်စပ်မှုလေ့လာခြင်း

ဒေါ်ခင်မေလွင်၊ B,Sc. (I.C) (Rgn.) 'k-okawoerSL:
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သစ်တောသုတေသနဌာန

## စာတမ်းအကျဉ်းချုပ်

မြန်မာနိုင်ငံတွင် သစ်တောစိုက်ခင်းများကို အရှိန်အဟုန်ဖြင့် တိုးချဲ့စိုက်ပျိုးလျက်ရှိပါသည်။ ဤကဲ့သို့ သစ်တော စိုက်ခင်းများ တိုးချဲ့စိုက်ပျိုးရာတွင် မြေဩဇာညံ့ဖျင်းလျက်ရှိသော အပူပိုင်း ဒေသ ကဲ့သို့သော နေရာများတွင် သစ်တော စိုက်ခင်းများတည်ထောင်ရာ၌ မြေဆီဩဇာ ထိန်းသိမ်းသည့် အပင်များ စိုက်ပျိုးခြင်းဖြင့် မြေဆီလွှာ ကောင်းမွန်အောင် ပြုလုပ်ပေးရန် လိုအပ်လျက်ရှိပါသည်။ ဤစာတမ်းတွင် ရေဆင်း ဒေသရှိ နိုက်ထြိုဂျင် ဓါတ်အကျိုးပြုသည့် ပဲမျိုးနွယ် သစ်တောပင်များအပါအဝင် ဘောစကိုင်း၊ မယ်ဇလီ၊ ကုက္ကို၊ ရှား၊ ပေါက်၊ စစ်၊ ယူကလစ်၊ ဘန့်ဘွေး၊ ဘင်္ဂနီပစေး၊ အင်၊ အင်ကြင်း သစ်မျိုးများ၏ အရွက်များနှင့် ၎င်းတို့ပေါက်ရောက်သော နေရာမှ သစ်တောမြေများကို ဓါတ်ခွဲစမ်းသပ်၍၊ သစ်တောပင်အချို့ နှင့် မြေဩဇာ ဆက်စပ်မှုကို လေ့လာတင်ပြထားပါသည်။

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## Abstract

The Forest Department has been establishing plantation extensively. For the establishment of new plantation at adverse site like in dryzone areas, soil improving species or leguminous species may be required. In this study soil properties of the site and foliar analysis for legumes and other tree species, such as Bawzagaing *(Leucaena leucocephala* DC.), Mezali *(Cassia siamea* lam.*),* Kokko *(Albizzia lebbek* Benth.*)* Sha (*Acacia catechu* Willd.), Pauk *(Butea monosperma* O, Ktze.), Sit *(Albezzia precera* Benth.), Eucalyptus (*Ecualyptus camaldulensis* Dehn.), Bambwe (*Careya arborea* Roxb.), Binga (*Mitragyna rotundifolia* O. Ktze), Nibase *(Morinda tinctoriz* Roxb,), In *(Dipterocarpus tuberculatus* Roxb.) and Ingyin *(Pentacme siamensis Miq.)* at Yezin were tested and Soil Nutrient-Vegetation relationship was discussed.

# Contents

# 1. Introduction

Burma possesses a wide variation in climatic and geological conditions, resulting in soil formation with tremendous variation in forest productivity. To increase the potential of Burma forests, the country is launching a large scale planting scheme of teak, other value commercial hardwoods, fuel wood, and other plantations, throughout the country, A wide range of soil and site conditions will be encountered when large-block plantations areas are thus established. Some of the species thus planted have been noted to grow very poorly in some of the sites due possibly, to deficiency in nitrogen, phosphorus, potassium or other nutrient elements, A unique characteristic of most forest ecosystem in the development of a distinct forest floor resulting from the periodic return through litter fall of leaves, branches, bark, fruit and sometimes the entire trees. The litter fall contains a large proportion of the nutrients extracted by the tree from the soils, with only a relatively small percentage retained in the growing biomass. The dead vegetation on the floor, in turn; decomposes, liberating minerals for reuse by the growing stand (Pritchett, 1978). The movement of bases in a forest soils has a strong influence on the properties of the soil developed under different types of vegetative cover. On the prairies all the leaves and stems of the grass with their content of bases are returned to the soil surface annually. In the forest a decidedly different cycle occurs since much of the nutrient supply taken up by the roots is stored in the tree trunks and branches (Millar et al , 1965).

The soil survey also provided data on the vegetation associated with the various site and it was found that soil nutritional status was a major determinant of tree species association. Many investigation with isotope-labelled plant materials have been conducted on the decomposition of plant residues in soil, both in the Laboratory and in the field and the relative decomposition of plant tops and roots have been reported (Lambert and Turner 1983). The analysis of leaves from fruit trees has been used for many years as a mean of, detecting tree response to various cultural treatments, determination of the nutrient elements associated with apparent nutrient disorders and estimating fertilizer need prior to the occurence of nutrient disorder (Kenwortty, 1961), Foliar analysis is particularly valuable in assessing the nutrient status of a crop even through the relationship between plant growth and foliar composition is a complex one (Dothie, 1969). The use of foliage analysis to assess the mineral nutrient status of plants growing in various environments has proved to be a reasonable effective procedure particularly in the interpretation of field fertilizer trials, in the diagnosis of trace element dificiency and in the establishment of provisional critical levels for the macronutrients (Wilde 1958, Humprey et al 1972).

In this study, soil nutrient-vegetation relationship for Leguminous and other tree species at Yezin were tested. Data on the concentration of nutrient in the foliage of the species are discussed in relation to the variations within species, different between species and relationship with soil nutrient levels.

# 2. Materials and Methods

## 2.1 Study Area

The study area, Yezin Forest Research Institute compound, is 56.7 hectare in area, and the altitude is 450 meters above the sea level. The rainfall generally occured during the period June to October and the average annual rainfall is 1120 mm. The average mean daily temperature ranges between 20° C to 32° C. The soil type is yellowish Brown Dry Forest Soil which derived "insitu" from sand-stone (Sein Thet and Pritchett 1981).

## 2.2 Field Sampling

Leaf samples collection were done in October 1984, from six leguminosae species, (Bawzagaing, Kokko, Mezali, Pauk, Sha, and Sit), two Rubiaceae species (Binga, Nibase) and Diptrocarpaceae species (In, Ingyin ) (Table 1.) Pauk, Sit Bambwe, Binga , Nibase, In and Ingyin are natural stand and the other five species were planted trees. Twelve composite foliar samples were taken from each tree including new leave, middle leave and old leave, by using a tree pruner. Fully expanded mature green leaves, with no evidence of insect damage, were selected from a number of branches. The collected samples were bag labelled and carried to the Laboratory.

## 2.3 Laboratory Method.

The collected leaf samples were dried in an oven at 70° C and crushed into powder with Thomas Wiley cutting mill, while soil samples were air dried and ground to pass through a 2 mm sieve prior to analysis. The know amount of soil samples and leaf samples (powder form) were analysed for nitrogen, Phosphorous, potassium, calcium, magnesium and sodium by using the following methods.

## 2.4 Total Nitrogen ($N_2$ %)

Total Nitrogen was determined from aliquots by Kjeldhal's method by using macro Kjeldhal's digestion and distillation unit.

Table 1. List of the selected tree species.

| Sr. No | Species | | Family | Remarks |
|---|---|---|---|---|
| | Burmese Name | Botanical Name | | |
| 1. | Bawzagaing | *Leucaena leucocephala* Dc. | LEGUMINOSAE | planted tree |
| 2. | Kokko | *Albizzia lebbek* Benth. | LEGUMINOSAE | planted tree |
| 3. | Mezali | *Cassia siamea* Lam. | LEGUMINOSAE | planted tree |
| 4. | Pauk | *Butea monosperma* O. Ktze | LEGUMINOSAE | natural stand |
| 5. | Sha | *Acacia catechu* Willd. | LEGUMINOSAE | planted tree |
| 6. | Sit | *Albizzia procera* Benth. | LEGUMINOSAE | natural stand |
| 7. | Bambwe | *Careya arborea* Roxb. | MYRTACEAE | natural stand |
| 8. | Eucalyptus | *Eucalyptus camaldulensis* Dehn. | MYRATCEAE | planted stand |
| 9. | Binga | *Mitragyna rotundifolia* O. Ktze. | RUBIACEAE | natural stand |
| 10. | Nibase | *Marinda tinctoria* Roxb. | RUBIACEAE | natural stand |
| 11. | In | *Dipterocarpus tuberculatus* Roxb. | DIPTEROCARPACEAE | natural stand |
| 12. | Ingyin | *Pentacme siamensis* Mig. | DIPTEROCARPACEAE | natural stand |

## 2.5 Available Phosphorus (P %)

Available phosphorus levels were assessed from aliquots by phosphomolybdenum blue method by using Perking Elmer model - 55 E Spectrophotometer at 600 nm wavelength.

## 2.6 Available Potassium, Calcium, Magnesium, Sodium. (K, Ca, Mg, Na %)

Leaf samples were used by wet digestion method and soil samples were used by double acid extraction method and the levels were determined by using Atomic Absorption Spectrophotometer, Perkin Elmer Model 2280.

## 3. Results and Discussion

**3.1** Mean nutrient concentration levels in soil under species tested were shown in Table 2. Wild et al (1972) stated that species of low requirement may be satisfied with a content of total nitrogen content as low as 0.07 %. It was observed that the mean nitrogen concentration levels under the species tested were ranged from 0.03 % to 0.17% and it was found that the highest nitrogen concentration level of 0.17% was under the In species.

**3.2** Available phosphorus levels in the surface soil were found nil to 0.002 % under the species tested. According to Wilde et al (1972), Within the study area the levels of phosphorus was found lower than the requirement for normal plant growth.

Table 2. Nutrient Concentration in Surface Soil Under the Species Tested.

| Sr. No | Species | Soil nutrient concentration | | | | | |
|---|---|---|---|---|---|---|---|
| | | Total $N_2$ % | P % | K % | Ca % | Mg % | Ava: Na % |
| 1. | Bawzagaing | .0876 | nil | .007 | nil | .0004 | .0043 |
| 2. | Kokko | .0366 | .00198 | .0204 | .0877 | .0096 | .0034 |
| 3. | Mezali | .1084 | nil | .0053 | nil | .0002 | .0021 |
| 4. | Pauk | .0840 | nil | .007 | nil | .0002 | .0022 |
| 5. | Sha | .1186 | nil | .0051 | nil | .0002 | .0015 |
| 6. | Sit | .0291 | .00077 | .0124 | .0385 | .0112 | .0013 |
| 7. | Bambwe | .0322 | nil | .0032 | nil | .0002 | .0011 |
| 8. | Eucalyptus | .1466 | .00061 | .008 | nil | .0034 | .0015 |
| 9. | Binga | .0970 | nil | .0046 | nil | .0002 | .0026 |
| 10. | Nibase | .0494 | .00055 | .015 | .0628 | .0106 | .0023 |
| 11. | In | .1706 | nil | .0080 | nil | .0007 | .0029 |
| 12. | Ingyin | .0738 | .00282 | .0139 | .0888 | .0144 | .0010 |

**3.3** Although the highest amount of available potassium 1 levels was found under Kokko (0.02 %), according to Wilde et al. the available potassium level under other species were also sufficient for plant growth.

**3.4** Nutrient concentrations of foliage, collected during the month of October were shown in Table 3. It was found that the nutrient concentrations varied greatly between species; but within families variation was low for most elements.

**3.5** According to Bengton (1981), the nutrient concentrations in foliage of temperate hard wood species were 1.54 % to 1.7 % of Nitrogen, 0.11 % to 0.14 % of Phosphorus, 0.62 % to 0.86 % of Potassium, 0.22 % to 1.38% of Calcium and 0.08 % to 0.42 % of Magnesium respectively. It was found that within the study area Calcium and Magnesium concentration were almost the same as Bengton levels while Nitrogen and Phosphorus were higher and the while Nitrogen and Phosphorus were higher and the concentrations of Potassium level was low.

**3.6** Nitrogen concentration of foliage was low, when compared with generally accepted value (Bengton 1981) for the species tested. Only five of the twelve species tested has more than 2 % nitrogen; while Binga had lowest concentration which was less than 1 % . As expected it was found that the foliage of leguminosae species are higher in Nitrogen contents than other non-leguminosae species.

**3.7** The concentration of phosphorus was highest in Bambwe foliage with more than 0.6 %. It was found that the potassium concentration was highest in Bawzagaing

Table 3. Nutrient Concentration in Foliage for Species.

| Sr. No | Species | Foliage Nutrient Concentration | | | | | |
|---|---|---|---|---|---|---|---|
| | | Total $N_2$ % | P % | K % | Ca % | Mg % | Ava: Na % |
| 1. | Bawzagaing | 2.426 | .449 | .783 | .245 | .288 | .005 |
| 2. | Kokko | 2.762 | .136 | .370 | .338 | .138 | .005 |
| 3. | Mezali | 2.133 | .243 | .238 | .950 | .132 | .010 |
| 4. | Pauk | 1.253 | .495 | .310 | .992 | .148 | .005 |
| 5. | Sha | 2.440 | .193 | .343 | .213 | .268 | .007 |
| 6. | Sit | 2.106 | .142 | .528 | 1.372 | .178 | .007 |
| 7. | Bambwe | 1.097 | .653 | .312 | .710 | .353 | .008 |
| 8. | Eucalyptus | 1.230 | .163 | .330 | .347 | .157 | .005 |
| 9. | Binga | .853 | .333 | .268 | 1.278 | .283 | .007 |
| 10. | Nibase | 1.369 | .263 | .483 | 1.242 | .490 | .007 |
| 11. | In | 1.362 | .112 | .392 | .437 | .233 | .007 |
| 12. | Ingyin | 1.538 | .331 | .172 | .828 | .182 | .008 |

foliage with more than 0.7 % but the concentration of calcium was the highest in Sit. Concerning Magnesium content, all the species were lower than Nibase, and it was found that Sodium concentration in all the species were lower than the requirement (according to Bengton).

**3.8** The relative proportion of nutrient in foliage for twelve species tested were found as follows. (In descending order). It was found that nitrogen concentration was highest and sodium was lowest while potassium, phosphorus, calcium and magnesium concentration were intermediate.

| | | |
|---|---|---|
| (1) Bawzagaing | LEGUMINOSAE | $N_2$ > K > P > Mg > Ca > Na |
| (2) Kokko | LEGUMINOSAE | $N_2$ > K > Ca > Mg > P > Na |
| (3) Mezali | LEGUMINOSAE | $N_2$ > Ca > P > K > Mg > Na |
| (4) Pauk | LEGUMINOSAE | $N_2$ > Ca > P > K > Mg > Na |
| (5) Sha | LEGUMINOSAE | $N_2$ > K > Mg > Ca > P > Na |
| (6) Sit | LEGUMINOSAE | $N_2$ > Ca > K > Mg > P > Na |
| (7) Bambew | MYRTACEAE | $N_2$ > Ca > P > Mg > K > Na |

| | | |
|---|---|---|
| (8) Eucalyptus | MYRTACEAE | $N_2$ > Ca > K > P > Mg > Na |
| (9) Binga | RUBLACEAE | Ca > $N_2$ > P > Mg > K > Na |
| (10) Nibase | RUBLACEAE | $N_2$ > Ca > Mg > K > P > Na |
| (11) In | DIPTEROCARPACEAE | $N_2$ > Ca > K > Mg > P > Na |
| (12) Ingyin | DIPTEROCARPACEAE | $N_2$ > Ca > P > Mg > K > Na |

**3.9** Correlation coefficient between nutrient levels of foliage and nutrient levels of soil were tested and it was found that all the species, except Kokko, were highly correlated (r is between 0.9970 and 0.8433) to each other. It showed that, the surface soil nutrient levels for a site can be determined, by foliage analysis of the species growing on that site.

## 4. Conclusion

**4.1** In this study the relative proportion of nutrient in foliage for the twelve species tested showed that nitrogen concentration was highest and sodium was lowest while potassium, phosphorus, calcium, magnesium concentration were intermediate in that order.

**4.2** It was found that within the study area, foliage concentration of calcium and magnesium were almost the same as Bengton levels, while nitrogen and phosphorus were higher and the potassium level was lower. It was also found that leguminosae species are higher in nitrogen contents than other non-leguminosae species .

**4.3** The correlation coefficient of nutrient levels between foliage and soil parameter were tested and found that foliage nutrient levels was correlated with soil nutrient level. It could be suggested that the use of foliage analysis could be effectively used to assess the surface soil nutrient levels for fertilization trials, and tree growth.

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